PREVENTION OF HYPOTENTION AFTER SPINAL ANAESTHESIA IN ELECTIVE CAESAREAN SECTIONS

Syed Jawad Rehmani, Asjad Sharif, Amna Gulrez

Combined Military Hospital Bahawalpur Pakistan

ABSTRACT

Objective: Comparing the efficacy of crystalloid pre-load and co-load on reducing hypotension and improving APGAR score in patients receiving spinal anaesthesia for elective caesarean sections.
Study Design: Randomized controlled study.
Place and Duration of Study: This study was carried out at Combined Military Hospital Bahawalpur, after seeking permission from ethics committee. The data was collected for 06 months from Jan to Jul 2017.
Methodology: Patients with ASA classification 1 and 2, aged 18-40 years were included. Group A received 15ml/kg Hartmann's solution as preloading solution in 15 minutes before the induction of spinal anaesthesia. Group B received 15ml/kg of Hartmann's solution as co-loading solution after performing a block in 15min.
Results: This study includes 314 patients (157 in each group). Our study population was slightly predominated by females 170 (54%) as compared to 144 (46%) males. The average Apgar score in both groups were 9.8 ± 0.58 and 9.7 ± 0.436. Out of 314 patients, 169 patients (54%) were ASA I and remaining 46% were ASA II. Overall hypotention was noted in 67 patients (21.3%) of group A and 30 patients (9.6%) of group B. The difference between two groups was statistically significant (p=0.001*). Improving Apgar score was noted in 54 patients (17.2%) of group-A and 117 patients (37.3%) of group-B. The difference between two groups was statistically significant (p=0.001*).
Conclusion: It is concluded that co-load is better than pre-load in reducing hypotension and improving Apgar score in patients receiving spinal anaesthesia for elective caesarean sections.

Keywords: Colloid, Crystalloid, Hypotension, Pre-loading.

INTRODUCTION

Spinal anaesthesia is widely used for elective and emergency caesarean sections. However its main drawback is hypotension which can cause nausea, vomiting, cardiovascular collapse and loss of consciousness in mother as well as fetal hypoxia and acidosis due to placental hypo-perfusion[1]. Hypotension is a common problem during spinal anaesthesia for caesarean delivery. Intravenous fluid loading is used to correct pre-operative dehydration and reduce the incidence and severity of hypotension. Different fluid regimens have been studied but crystalloid preload and crystalloid co-load have never been compared. The secondary outcome of the study was ephedrine requirement for maintaining maternal blood pressure and neonatal outcome in terms of fetal APGAR score. The aim of the study was to compare the efficacy of crystalloid pre-load and co-load on reducing hypotension and improving APGAR score in patients receiving spinal anaesthesia for elective caesarean sections.

Spinal anaesthesia is a safe technique for caesarean section as compared to the general anaesthesia as it is associated with low maternal morbidity and mortality[2]. Effective surgical anaesthesia block up to the level of T4-T6 dermatome[3] is the primary objective of the spinal anaesthesia technique and it must be accomplished while minimizing maternal and neonatal side-effects[4]. Higher incidence of maternal hypotension is one of major disadvantages of spinal anesthesia[5]. Maternal hypotension may have detrimental effects on uterine blood flow, fetal well-being and ultimately neonatal outcome. Hypotension may impair placental circulation as well as

Correspondence: Dr Amna Gulrez, Dept of Anaesthesiology, Combined Military Hospital, Bahawalpur Pakistan
Received: 18 Mar 2019; revised received: 17 Aug 2019; accepted: 17 Aug 2019

circulation to vital organs. Development of hypotension has various clinical manifestations such as nausea, vomiting and dizziness which often interfere with surgery[6]. There are certain physiological changes during pregnancy resulting in increased sensitivity to local anaesthetics during regional anaesthesia and analgesia. Aortic compression also called supine hypotension syndrome occur due partial or near partial occlusion of inferior vena cava by the to gravid uterus that can lead hypotension with tachycardia which is when combined with hypotensive effects of regional anaesthesia can cause fetal asphyxia and poor APGAR score.

Hypotension in spinal anaesthesia is caused by sympathetic blockade leading to vasodilatation. A variety of measures to improve venous return includes leg wrapping, anti-thromboembolic stockings, patient positioning, intravenous fluids and Vasopressors administration have been used for prevention of hypotension with mixed success[7]. Crystalloid solutions do not remain in intravascular space but distribute rapidly into the extracellular space. Therefore the timing of infusion is important to prevent hypotension because the volume expanding effect is maximal immediately after administration. Pharmacokinetic studies predict fluid administration to be more effective if delayed until induction of spinal anaesthesia and rapidly infused there after[8]. Phenylephrine has been used as a newer and safer drug in these cases and the review of available literature has shown that little or no work has been done regarding efficacy of crystalloid pre-load or Co-load when co-administered with phenylephrine[9].

The strength of our study lies in the usage of phenylephrine which controlled the confounding factors seen in the majority of previous studies done with ephedrine[10]. With this control, we were better able to analyze/determine the efficacy of crystalloid pre-load and after-load. The results of this study helped to devise the best practice for management of hypotension and lower APGAR score. Hence, the physicians were able to control the patients morbidity and mortality related to such a common surgical procedure i.e. caesarean section.

METHODOLOGY

This randomized controlled study, was carried out in department of Anaesthesiology and Intensive Care, Combined Military Hospital, Bahawalpur, Pakistan. Sample size was calculated by using WHO Calculator Peter Chiam and KC Lun national university of Singapore open resource sample size formula for the hypothesis testing of difference in two proportions were calculated as: P1=46% (10), P2=60% (10), C.I=95%, power of the test=80%, Total sample size is n=314 which were further stratified in to two groups i.e. 157 in each groups. Inclusion of samples in the study was made on specific criteria. Inclusive criteria I) American Society of Anaesthesiology (ASA) class 1 and 11. II) Age between 18 to 40 years. III) elective caesarean section. IV) Gestational age full term (37 to40 weeks) assessed by Last menstrual period. Sampling technique was non-probability convenient sampling. Samples excluded from the study were evaluated earlier on follow-ups and regular checkups by the help of lab findings and history. Exclusion of the samples were based on I) Obesity II) Anemia III) Diabetes IV) Pregnancy-induced hypertension, chronic hypertension, heart disease V) Known fetal abnormalities VI) Multiple gestations VII) Kyphoscoliosis XIII) Premature delivery We hypothesize that co-load is better than preload in reducing hypotension and improving APGAR score in patient receiving spinal anesthesia for elective caesarean sections.

The data was collected after the informed consent of the patients. After proper pre-anaesthesia assessment, baseline non-invasive blood pressures were recorded. Names of both methods (pre-load and co-load) were written on two separate papers and put in two plain envelopes of same size and color. Patients were asked to pick one of the envelopes and the patients were administered crystalloid preload or co-load depending upon the method written inside. Patients were divided into 2 groups i.e. group A

(Pre-load group, received 15ml/kg Hartmann's solution as preloading solution in 15 minutes before the induction of spinal anesthesia) and group B (co-load, received 15ml/kg of Hartmann's solution as co-loading solution after performing a block in 15min). Systolic blood pressure (SBP) was recorded after 01, 03, 05 minutes. Hypotension was treated with Intravenous boluses of 100 microgram of phenylephrine and additional 100 ml of rapid infusion of Hartmann's solution. After birth, neonatal APGAR scores were recorded after 5 min of birth.

The collected data was entered and analyzed by SPSS version 21. Mean and standard deviation was calculated for numerical variables like age, heart rate & oxygen saturation and dose of phenylephrine. Frequencies and percentages were calculated for categorical variables like gender, ASA Status, hypotension (Yes/No) & APGAR Score >7 (Yes/No). Effect modifier was controlled through stratification like age, gender, ASA Status, to see the effect on main outcome variable appropriate chi-square test were applied-value <0.05 was taken as significance.

RESULTS

A total of 314 cases (157 in each group) fulfilling the inclusion/exclusion criteria were enrolled to compare the efficacy of crystalloid pre-load and co-load on reducing hypotension and improving APGAR score in patient receiving spinal anaesthesia for elective caesarean sections.

The mean age was 29.36 ± 4.36 years and the mean age of patients in pre and co load was recorded 28.38 ± 5.07 vs 29.12 ± 4.51. The mean APGAR score in both groups were found 9.12 ± 0.58 and 9.7 ± 0.436. Mean Systolic blood pressure of women in both pre and co load were noted 129.85 ± 8.7 and 121.36 ± 5.46 in mmHg respectively. Mean heart rate of women in both pre and co load were noted 83.49 ± 9.44 and 81.94 ± 8.84 in min respectively as shown in table-I. Average number of doses of phenyl in both pre and co load were noted 2.0 ± 1.67 & 1.0 ± 0.9 in mmHg respectively.

The comparison of efficacy of crystalloid pre-load and co-load on reducing hypotension and improving APGAR score in patient receiving spinal anesthesia for elective caesarean sections found statistically significant and the reducing hypotension was noted in 67 patients (21.3%) of group-A and 30 patients (9.6%) of group-B. The

Table-I: General characteristics of the patients.

	Preload	Co Load
N	157	157
Age (year)	28.38 ± 5.07	29.12 ± 4.51
Apgar score at 5 min	9.12 ± 0.58	9.7 ± 0.436
Gestational age (Wk)	37.2 ± 0.5	37.9 ± 0.89
Systolic blood pressure (mmHg)	129.85 ± 8.7	121.36 ± 5.46
Heart rate per min	83.49 ± 9.44	81.94 ± 8.84
Oxygen saturation	97.58 ± 1.676	98.43 ± 1.678

Total n=314, age 29.36 ± 4.36 years. Values are Mean ± SD

Table-II: Comparsion of crystalloid pre-load and co-load with ASA status in reducing hypotension in patient receiving spinal anaesthesia for elective caesareansections (n=314).

ASA Status	Patients Groups		Total
	Preload (n=157)	Co Load (n=157)	
	Hypotension (Yes/No)	Hypotension (Yes/No)	
ASA-I	67 (21.3%) 90 (28.7%)	3 (1%) 9 (2.7%)	0.231
ASA-II	- -	27 (8.6%) 118 (37.6%)	-
Total	67 (21.3%) 90 (28.7%) 157 (50%)	30 (9.6%) 127 (40.4%) 157 (50%)	0.001

Table-III: Comparsion of crystalloid pre-load and co-load with asa status in improving apgar score in patient receiving spinal anaesthesia for elective caesarean sections (n=314).

ASA Status	Patients Groups		Total
	Preload (n=157)	Co Load (n=157)	
	Improvement of Apgar scor (Yes/No)	Improvement of Apgar scor (Yes/No)	
ASA -I	54 (17.2%) 103 (32.8%)	3 (1%) 9 (2.9%)	0.507
ASA-II	- -	114 (36.3%) 31 (9.9%)	-
Total	54 (17.2%) 103 (32.8%) 157 (50%)	117 (37.3%) 40 (12.7%) 157 (50%)	0.001

difference between two groups was statistically significant (p=0.001*) (table-II). Overall improving APGAR score was noted in 54 patients (17.2%) of group-A and 117 patients (37.3%) of group-B. The difference between two groups was statistically significant (p=0.001*) (table-III).

DISCUSSION

Hypotension resulting from intrathecal injection of a local anaesthetic is the commonest complication of spinal anaesthesia. It is caused by sympathetic blockade in the segments affected by the block, causing vasodilation, reduced venous return to the heart and a reduced cardiac output and can even lead to cardiac arrest in some patients. Pregnancy exacerbates the problem and it is associated with symptoms such as dizziness, nausea and vomiting and can cause restlessness. Nausea and vomiting are associated with dissatisfaction with spinal anaesthesia. These may lead to women refusing spinal anaesthesia in subsequent caesarian sections[11].

This study was carried out to test the hypothesis that crystalloid co-load is a better option than crystalloid preload to prevent maternal hypotension during spinal anaesthesia in elective caesarean section. The most common side effect associated with spinal anaesthesia is hypotension. In present study, hypotension developed in 62.2% and 48.6% of the patients in preload group and co-load group, respectively (p=0.242). The value of previous preloading techniques for treatment of hypotension associated with spinal anaesthesia for caesarean section has now been questioned by many studies. Crystalloid preload both with and without uterine displacement without any prophylactic measure showed hemodynamic instability in many parturients[12]. Crystalloid solutions have shorter half-life of 15-20 minutes and rapidly diffuse into interstitial space, decrease its efficacy for prevention of post spinal hypotension. Different volumes of crystalloid preload 10, 20 and 30ml/kg, suggested that the incidence of hypotension was not reduced with either techniques, fluid resuscitation should be targated to physiological needs of patiens[13]. Colloid co-load can decrease the amount of ephedrine[14]. Administration of large volumes of preloaded fluid may result in hemodilutionand having the risk of development of pulmonary edema in susceptible patients[15].

Volume kinetic studies of Ringer Lactate solution during general and spinal anaesthesia by Ewaldsson *et al*, suggested that fluid administration at time of induction of anaesthesia better maintained the arterial pressure than by preloading[16]. Dyer *et al* postulated that coloading limit fluid redistribution and excretion as it contribute to intravascular volume at the time of maximal vasodilatation as a result of spinal anaesthesia induced sympathetic blockade. The results of this study showed that the incidence of spinal induced hypotension in the coload group was less as compared to the preload group (48.6% vs 62.2%), however this difference was statistically insignificant. Previous studies have shown variable incidence of hypotension in the preload and coload groups in obstetrical patients. Dyer *et al* who compared 20ml/kg crystalloid solution in parturients, reported that 84% hypotension developed in the preload group and 60% in the coload group[17]. Cardoso *et al* observed the incidence of hypotension as 22.5% and 25% in the co-load and preload groups respectively[18]. In contrast to above findings, Bouchnak *et al*[19] who compared 20 ml/kg of crystalloid as co-load or preload in the parturients[19] noticed a higher incidence of hypotension in the co-load group (96.6%) versus preload group (86.6%). The differences in these studies may be due to the different amount of crystalloids used, definitions of hypotension used in the studies vary, height of block, drugs effect and the difference in the rates of administration of the crystalloids. The results of this study is close to the study of Bannerjee *et al*, a meta-analysis, who noticed the incidence of hypotension 59.3% in the co-load group as compared with 62.4% in the preload group during spinal anaesthesia in elective caesarean section[20]. The difference between the two groups was statistically not significant.Hence co-loadingwith a

crystalloid is beneficial both for the parturient and the baby[21].

CONCLUSION

It is concluded that both crystalloid preloading and co-loading, when used alone, are effective to prevent the spinal anaesthesia induced hypotension in the obstetrical patients. The results showed co-load was better than pre-load in reducing hypotension and improving Apgar score in patients receiving spinal anaesthesia for elective caesarean sections.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Hasanin A, Mokhtar AM, Badaway A, Fouad R. Post spinal anaesthesia hypotension during caesarean delivery,a review article. Egyptian J Anaes 2017; 33(2): 189-93.
2. Mc Donald S, Fernando R, Ashpole K, Columb M. Maternal cardiac output changes after crystalloid or colloid coload after spinal anaesthesia for elective caesarean delivery: a randomized controlled trial. Obstetric Anesthesia Digest 2012; 32(4): 238-39.
3. Butterworth J, Mackey DC, Wasnick J. Morgan and Mikhail's clinical anaesthesiology. Mc Graw Hill Professional; 2013. https://d1wqtxts1xzle7.cloudfront.net/56663931/Morgan_and_Mikhails_Clinical_Anesthesiology_5th_edition.pdf?1527412212=&response-content.
4. Arzola C, Wieczorek PM. Efficacy of low-dose bupivacaine in spinal anaesthesia for Caesarean delivery: systematic review and meta-analysis. Br J Anaesth 2011; 107(3): 308-18.
5. Oh AY, Hwang JW, Song IA, Kim MH, Ryu JH, Park HP, Jeon YT, Do SH. Influence of the timing of administration of crystalloid on maternal hypotension during spinal anaesthesia for caesarean delivery: preload versus coload. BMC Anesthesiol 2014; 14(1): 1-9.
6. Sng BL, Tan HS, Sia AT. Closed loop double vasopressor automated system vs manual bolus vasopressor to treat hypotension during spinal anesthesia for caesarean section: a randomized controlled trial. Anaes 2014; 69(1): 37-45.
7. Hobbs A, Cockerham R. Managing hypotension during anaesthesia for caesarean section. Anaesth Intens Care 2013; 14(7): 280-82.
8. Loubert C. Fluid and vasopressor management for Caesarean delivery under spinal anaesthesia: continuing professional development. Can J Anaesth 2012; 59(6): 604-01.
9. Parmar SB, Sheikh AN, Shalu PS. A comparative study of preloading versus coloading of crystalloid to prevent spinal anaesthesia induced hypotension. J Evolution Med Dental Sci 2012; 5(1): 746-53.
10. Lin FQ, Qiu MT, Ding XX, Fu SK, Li Q. Ephedrine versus phenylephrine for the management of hypotension during spinal anaesthesia for caesarean section: an updated meta-analysis. CNS Neurosci Ther 2012; 18(7): 591-97.
11. Matthews C. A review of nausea and vomiting in the anaesthetic and post anaesthetic environment. J Perioper Pract 2017; 27(10): 1750-89.
12. Young A, Hwang JW, Song IA, Kim M, Ryu J, Park HP, et al. Influence of timing of administration of crystalloids on maternal hypotension during spinal anaesthesia for caesareandelivery: preload vs coload. BMC Anesthesiol 2014; 14(1): 36-42.
13. Lira A, Pinsky M. Choice in fluid type and volume during resuscitation:impact on patient outcome. Ann Intensive Care 2014; 4(1): 1-13.
14. Wani S. Comparative study to evaluate the effect of colloid coloading versus crystalloid coloading for prevention of spinal anaesthesia induced hypotention and effect on fetal Apgar score in patients undergoing elective lower segment caesarean section:a prospective observational study. J Reprod Contracept Obstet Gynecol 2018; 7(5): 1868-75.
15. Dabbagh A, Esmalian F, Aranki S. Poatoperative critical care for adult cardiac surgical patients. 2nd ed. Springer; 2018. https://www.springer.com/gp/book/9783319757469.
16. Ewaldsson CA, Hahn RG. Volume kinetics of ringer's solution during induction of spinal and general anesthesia. Br J Anaesth 2001; 87(1): 406-14.
17. Dyer RA, Farina Z, Joubert IA, Du Toit P, Meyer M, Torr G, et al. Crystalloid preload versus rapid crystalloid administration after induction of spinal anaesthesia (coload) for elective caesarean section. Anaesth Intensive Care 2004; 32(3): 351-57.
18. Cardoso MM, Santos MM, Yamaguchi ET, Hirahara JT, Amaro AR. Fluid preload in obstetric patients. How to do it? Rev Bras Anaestesiol 2004; 54(5): 13-19.
19. Bouchnak M, Ben Cheikh N, Skhiri A, Yaacoubi M, Menif MA, Smaoui-M, et al. Relevance of rapid crystalloid administration after spinal anaesthesia (coload) in prevention of hypotension during elective caesarean section: A685. Eur J Anaesthesiol 2006; 23(1): 178-83.
20. Banerjee A, Stocche RM, Angle P, Halpern SH. Preload or coload for spinal anesthesia for elective Caesarean delivery: a meta-analysis. Can J Anaesth 2010; 57(6): 24-31.
21. Kaufner L, Karekla A, Henkelmann A, Welfle S, von Weizsäcker K, Hellmeyer L, et al. Crystalloid coloading vs colloid coloading in elective Caesarean section: postspinalhy potention and vasopressor cosumption, a prospective, observational clinal trial. J Anesth 2019; 33(1): 40-49.